Evaluating of Total Antioxidant and Total Oxidant Capacities in Organic and Non-Organic Apples and in the Blood of Their Producers

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Abstract: In this study there are two aims determined. Initially, the total antioxidant, and oxidant capacities will be compared in apples which are produced by using the pesticides including various effective chemicals and the apples produced in an organic way by using natural animal fertilizers and commercial organic fertilizers. Secondly, the antioxidant, and oxidant capacities of the workers' blood samples who are applying the pesticides, and the ones who are working in producing the organic apples.
The total antioxidant, and oxidant capacities of the blood samples taken from 30 workers who were applying the pesticides, and 30 workers who were producing the 30 organic apples at least for 3 years, and of the apples they produced were analysed.
The total antioxidant and oxidant capacities were measured using direct measurement kits for spectrophotometry.
As a result of the spectrophotometric analyses, no significant difference ($p>0.05$) between the total antioxidant, and oxidant levels of the organic and non-organic apples was determined. Besides, the antioxidant capacity of the workers applying the agricultural chemicals in producing the apples showed a significant decline compared to the workers who were producing the organic apples ($p<0.05$). In addition, the oxidant capacity of the workers applying the agricultural chemicals in producing the apples showed a significant increase compared to the workers who were producing the organic apples ($p<0.05$).
These results indicate that pesticide applications do not cause a change in the total antioxidant, and oxidant capacities of the apples. However, the workers who are applying the pesticides can be affected negatively by these chemicals, in the mean of the decreased total antioxidant capacity, and increased total oxidant capacity.

Keywords: Pesticides, organic apple, non-organic apple, total antioxidant status (TAS), total oxidant status (TOS).

Introduction

Today in Turkey the use of chemicals and chemical fertilizers although not yet as high as in European countries, the amount is not to be underestimated. The amount of chemical fertilizer used in our country 1-4 kg / ha, but ranged in total 9.8 million tons / year at the level (1).
Ecological conditions suitable for organic production and a large production potential of our countries, organic produce and food market share in the world, unfortunately, is too low (2). However, organic agriculture in Turkey is increasing every year, around 20% (3).

Isparta, Karaman, especially to our country and in many provinces are in intensive apple production. Appropriate in terms of the Isparta ecology of apple cultivation and has considerable potential. In Turkey, nearly one-fifth of the apple offered for consumption are produced in Isparta (4). Plant-origin food consumption as a result, only the important antioxidant vitamins (vitamins C, E, A), but also the antioxidant properties of natural compounds as well (flavanoller, catechin, flavonoids, etc.), nutrition can assure you. Recent studies showing the antioxidant activity of substances that occur because of oxidative stress, cataracts, cancer, cardiovascular diseases, neurological diseases, such as playing a significant role in the prevention of many degenerative diseases has revealed that (5–7). Apples, contain phytochemicals that have powerful antioxidant activity. A large part of these phytochemicals are phenolic components. Phenolic components of apple flavonoids; flavonoller (quercetin and glycosides) that are specific only to Apple dihidrokalkonlar (floridzin and floretin) is composed from. Most of the other phenolic compounds chlorogenic acid in apples are (8–10). Pesticides in our country use every day increases, but the practitioners' (producers, workers, or paid agents make those), drug preparation and during application take precautions not or extra doses of medication to do because of some health and environmental problems arise. Isparta in terms of agricultural workers in the state is consistent with our country's problems (11).
Agriculture in the widely used pesticides, hydrogen peroxide (H_2O_2), superoxide (O_2) and hydroxyl radical (-OH) as reactive oxygen species formation or by causing oxidant and antioxidant capacity changes may cause. These radicals can react with biological macromolecules such as enzyme inactivation, and can also cause DNA damage (12).
Two targets have been identified in this study. The first of these goals, and pesticides with organic apple production in the total antioxidant capacity (TAC) and total antioxidant capacity (TOC), and the second in the TAC that the blood of persons producing apples and compare TOC.

Materials and Methods

Apple samples in the study due to Isparta Gelendost within the boundaries of the district were collected from apple orchards. The blood samples, taken from the person who produced these apples. This purpose, the pesticides used (diazinon, chlorpyriphos, thiacloprid, phosalone, methidation, deltamethrin, cypermethrin, Carbaryl, 98% copper sulfate) produced 30 apple samples and these apples for at least 3 years use pesticide that 30 person's blood taken. 30 apple producers also produced by means of the organic (natural organic manure and commercial fertilizers), 30 samples with Apple is that Apple produces at least three years, 30 people were taken from the blood. An evaluation questionnaire to participants in the study was performed, and those with any chronic illness, or non-alcohol-dependent individuals are not included in the study. Apples used in the study, the average weight of 140 g apples Starking are denominated.
Apple in the blood in the TAC and TOC values in 2004 and Erel (13, 24) developed by the TAC and TOC direct measurement kit using [(Total antioxidant status (TAS), total oxidant status (TOS) - Rel Assay-Turkey)] spectrophotometrically determined.
Erel TAC test (13), a technique developed by the fully automated and powerful body against free radicals is a method for measuring the total antioxidant capacity. Fe2 +-o-dianisidine complex with hydrogen peroxide by Fenton-type reaction generates OH radicals. This powerful, low pH, colorless reduced reactive oxygen species react with o-dianisidine molecules to yellow-brown dianisidin radical form. Dianisidin radicals advanced oxidation reactions by participating in the formation of color is increasing. However, examples of antioxidants that stop the oxidation reaction suppressed the formation of the access to the colors. Automated analyzers used in this reaction results are given as measured spectrophotometrically. Traditionally used as a standard of the water soluble vitamin E analogue, Trolox was used, and the results mmol Trolox equiv. / L is expressed as. TOC measurement again Erel (24) by a colorimetric method developed fully automated. Ferrozine-oxidants found in the sample ions are oxidized to o-dianisidin complex ferric ions. Accelerate the reaction medium contained glycerol is about three times out. Ferric ions in acidic media "xylenol orange" color with a complex form. Oxidants found in samples of the color intensity is related to the amount as measured spectrophotometrically. Perkin Elmer brand spectrophotometric analysis (UV / Vis spectrophotometer model lambda 20 - USA) spectrophotometer was carried out.
Tubes were taken to study biochemistry in the blood. Within days of the cold chain reached the laboratory has been the blood centrifuged at 5000 rpm for 10 minutes. After taking blood samples until analysis and

stored at -80 ° C freezer. Primarily on analysis of blood was transferred to the refrigerator at +4 ° C, then melted at 37 ° C hot water bath is used for analysis spectrophometric.
Spectrophotometric TAC and TOC measurements in blood and apples in the bathtub for the first of three separate spectra were taken and their 800'er mL in reagent 1 (R1) has been applied. Then a 50 mL standard on one of these containers, standard and sample were added 2. Spectrophotometer at 660 nm and then the absorbance readings were recorded. 125 mL of these reagents to them, then two (R2) were added at room temperature for 10 minutes was expected. Finally, also the second 660 nm absorbance was read and recorded.
OSI values, the TOS value is calculated by dividing the value of the TAS (24). SPSS 15.0 statistical evaluation of data entered into the program, calculations were made using t-test.

Results

Demographic characteristics of study participants are given in Table 1.

	Male		Female		Total	
	n	%	n	%	n	%
Those who do drugs	27	90	3	10	30	100.0
Those organic production	26	86.6	4	13.4	30	100.0
Total	53	88.3	7	23.4	60	100.0

Table 1. Demographic characteristics of study participants

Applied pesticides in apples and organic apples in the TAC, TOC, and p values in Table 2 are given.

	Average (µmol trolox equivalent/g)	p value
Apples produced with pesticides (TAC) (n=30) Organically produced apples (TAC) (n=30)	1,74 1,75	>0,05
Apples produced with pesticides (TOC) (n=30) Organically produced apples (TOC) (n=30)	1,58 1,60	>0,05

Table 2 Applied pesticides in apples and organic apples in the average TAC, TOC and P values.

As can be seen in Table 2, produced with pesticides, and organic apples in a significant difference compared to TAC and TOC values was found (p> 0.05). But not significantly higher TAC of apples produced in the organic way, as determined TOC lower. The person who made pesticides and organic apple production in the blood of the person making the TAC, the TOC and p values are given in Table 3.

	Average (µmol trolox equivalent/g)	p value

Pesticides in the blood of the person who made TAC (n=30) Organic production in the blood of the people TAC (n=30)	1,59 1,63	<0,05
Pesticides in the blood of the person who made TOC (n=30) Organic production in the blood of the people TOC (n=30)	1,65 1,60	<0,05

Table 3. The person who made pesticides and organic apple production in the blood of the person making the TAC, TOC and p values.

Table 3 with the results that can be seen pesticides using the apple production of the person who made the blood of the TAC on the average, organic apple production the person who made the blood of the TAC values than the average significantly ($p < 0.05$) lower TOC values, the average is significantly ($p < 0$, 2005) were higher. TAC and TOC values of each group of oxidative stress index (ODI) was calculated to make the pesticides from the other group of people OSI (OSI= TOS/TAC × 100) significantly ($p < 0.05$) were higher (Table 4).

	Average OSI value (OSI= TOS/TAC × 100)	p value
People who made pesticides (n=30) People who makes organic production (n=30)	103,7 98,7	<0,05

Table 4. Using pesticides and organic apple production to production of individuals in the OSI and the p values of the blood of the people.

As shown in Table 4, apple production in persons with pesticides, OSI, compared with those of organic produce a significant increase ($p < 0.05$) was observed. As with pesticides, and organic apple production OSI values of men and women who make a significant difference was found compared (Table 5). However, although not statistically significant for both pesticides and organic produce in the group who were higher in OSI.

	Average OSI value(OSI= TOS/TAC × 100)	p value
Men who make pesticides (n=27) Women who make pesticides (n=3)	104,2 103,5	>0,05
The men's organic produce (n=26) The women's organic produce (n=4)	99,3 98,2	>0,05

Table 5. With pesticides, and organic apple production of the women and men TAC, TOC, and p values.

Discussion

Like many other fruit apples high amounts of vitamin C, vitamin E and the risk of cancer by reducing DNA damage and contains valuable antioxidants. Apple contains vitamins and antioxidants with the diet is an important fruit. Apple radical trapping tests showed high antioxidant activity (14).
A study in Finland, kuersetin'den rich apple consumption increases have been reported to decrease coronary mortality (15). In a study conducted in Hawai'i with apple consumption has been identified a negative relationship between lung cancer and its relationship with Apple that may stem from antioxidants have

been reported (16). In our study, the organic way (natural animal manure and commercial organic fertilizer) is produced, as well as several effective chemicals containing (diazinon, chlorpyriphos, thiacloprid, phosalone, methidation, deltamethrin, cypermethrin, Carbaryl, 98% copper sulfate), pesticides produced by Apple in the TAC significant values were higher. The cause of the apple produced in these two groups and that the antioxidant properties against free radicals consumed in diseases such as cardiovascular disease and cancer can be said to show a protective effect. This study produced using pesticides and organic apple production in the TAC and TOC was determined by the two groups, and TAC - TOC Apple found a significant difference between values (Table 2).

In 2005 study conducted by Karadeniz and colleagues, pomegranate, quince, apples and grapes in the morning as the highest antioxidant activity was determined. The same study, Cooper kind of apples average antioxidant activity mean% 14.7 Golden Delicious type apple mean antioxidant activity% 20.7, our research we also used Starking kind of apples average antioxidant activity while 19.5% have been reported (9).

Production of organic products in research on food quality and environmental health has revealed positive effects (17, 18). In our investigation, the apples in organic apple production was not due to a significant increase in TAC. Organic apple production in the same way, Apple does not cause a change in the TOC (Table 2).

Live in the TOC, external to the body directly can be received, or in the body, some reactions during the open can crop up and to DNA affecting the genetic damage, lipid effects by cell membrane dysfunction or protein by acting on the enzymes in the loss of function which may lead to radicals occurs. The body against oxidative stress TAC various substances such as enzymes and vitamins is a defense mechanism consisting of (19). Plasma and body fluids found in the TAC reflects the total effect of all antioxidants. This is why the blood antioxidant status in determining individual antioxidants, rather than giving them the value of the total antioxidant measurement is widely TAC (19).

Approximately one fifth of apples produced in Turkey are produced in Isparta (4). Apple production in the region is quite high, brings extensive use of pesticides. But the research about the use of the pesticide manufacturers in the region has revealed the inadequacy of (11.20). The results of this lack of research has proven once again. Because pesticides do people with TAC values, the organic produce of the people TAC values when compared with significantly ($p < 0.05$) reduced, the TOC values were compared, a significant increase ($p < 0.05$) is true (Table 3).

In a survey of pesticides to people mainly organophosphorus insecticides (diazinon, chlorpyrifos, thiacloprid, phosalone, methidation) were used. Piretroit this group of synthetic insecticides (deltamethrin, cypermethrin) and carbamat insecticides (Carbaryl) follow (11). Drugs for at least three years of our work, including the person who has been. Therefore, some pesticide applicators in the history of our country in 2008, prohibited the use of endosulfan pesticide active ingredient have been identified in their survey. This study pesticides made of people (producers, workers, or paid agents of the person making the) blood in the TAC and TOC values and organic apple production of the employees (producers, workers, or paid agents of the person making the) blood in the TAC and TOC values compared to Apple Contrary significantly ($P < 0.05$) difference was found. TAC and TOC results in terms of these pesticides did not affect the quality of apples, but in terms of reduced TAC and increasing TOC pesticides adversely affect the health of the person making the shows.

In our survey of women and men who do drugs and TOK TAK average men and women produce and organic apple compared to the average of the TAC and TOC was significantly ($p < 0.05$) difference was found (Table 5). Although not statistically significant, men have more than OSİ'lerinin longer than men do these jobs and their studies may have resulted in heavy work (Table 4).

Excessive formation of reactive oxygen compounds, for whatever reason or lack of antioxidant defense systems and repair systems are developed as a result of oxidative stress (21).

Pesticides reduce antioxidant capacity, by increasing antioxidant capacity, causing oxidative stress have been many studies showing that (22.23). This current study also yielded results consistent with the literature data. People who make pesticides OSI (increased oxidant capacity, decreased antioxidant capacity) OSI of organic production compared with the person who made a significant increase ($p < 0.05$) was determined.

Altuntas and colleagues at work, in the Mediterranean region is widely used organophosphate pesticide fasolonun in vitro lipid peroxidation and antioxidant defense systems were examined on the effects. Fasolon, malondialdehyde (MDA) formation increased, superoxide dismutase (SOD), glutathione peroxidase (GSH-Px) and catalase (CAT) has led to a decrease in activity. Fasolonun very high

concentrations but these effects are only lethal dose level were observed (23). SOD, GSH-Px and CAT antioxidant enzymes in our body is called. In this study, blood taken from these enzymes, including the PAC were measured and Altuntas and colleagues working in parallel with the pesticides to the victim in the TAC was significantly lower than was found. TAC and TOC in our body is in balance. TOS / TAS is OSI's rate (24). In this study, an increase TOC, TAC's reduction, direct and may be caused by an increase OSI. OSI increased atherosclerosis in people with a pesticide application, may increase the risk of cancer and premature aging.

During five years of agricultural workers exposed to pesticides total of 41 healthy men, age and economic status of the 21 individuals with the same free radical formation, lipid peroxidation, antioxidant status and the cellular enzyme activity determination were compared. Compared with the control group significantly increased MDA in agricultural workers. Glutathione, α-tocopherol, ascorbic acid and ceruloplasmin concentrations of antioxidants, such as the control group significantly decreased compared with (25). Participated in this study, a large portion of the 30 pesticide applicators (n = 15) consisted of agricultural workers. Pesticide applicators, while the remaining 12 were producers, 3 are doing this job for payment. TAC of 15 agricultural workers is calculated separately as this value was 1.60. Kisby and his colleagues working in the orchards in their study of pesticides on farm workers, the negative impact of oxidative stress and DNA have been put forward. The results in the context of a relationship between pesticides and cancer incidence may be increasing attention was (26).

As a result, the use of pesticides in growing the food, the environment and human health is threatened. The person who made this study of pesticides in blood TAC and TOC reduction in growth and therefore increase the value determined OSI, the long-term adverse effects of exposure to pesticides have been found out once again. TAC and TOC in pesticide applications, but Apple did not cause significant change in the value produced as organic pesticides applied to apples with apples produced in the TAC and TOC values were found to show similarities. Organic farming practices that have an impact on Apple is not in the TOC or TAC, the apples that produce a positive impact on the health of people suggest.

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